In conclusion, it deserves to be mentioned that there appears to exist a similar series of arsenetted ureas. Triethylarsine, when left for some weeks in contact with sulphocyanide of phenyl, deposits small crystals of a body which I believe to be the arsenic-compound corresponding to the phosphorus-urea described in this paper. This body requires a more minute examination.

II. "On the Deflection of the Plumb-line in India caused by the Attraction of the Himalaya Mountains and the elevated regions beyond, and its modification by the compensating effect of a Deficiency of Matter below the Mountain Mass." By the Venerable Archdeacon PRATT. Communicated by Mr. STOKES, Sec. R.S. Received October 25, 1858.

(Abstract.)

The author begins by referring to his former paper, published in the 'Transactions' for 1855, in which he calculated the deflections caused by the mountain mass on the north of Hindostan, at three principal stations of the Great Arc, in the plane of the meridian, viz. Kaliana (lat. 29° 30′ 48″), Kalianpur (24° 7′ 11″), and Damargida (18° 3′ 15″). He made them 27″·853, 11″·968, and 6″·909 (or more correctly, as revised in the present Paper, 27″·978, 12″·047, and 6″·790); and showed that the comparison of these two portions of the arc—which, if it *be* elliptical, and if the amplitudes are accurately known, ought to give the exact ellipticity of the arc in question—gives an ellipticity of $\frac{1}{426}$, instead of the mean $\frac{1}{300}$.

2. He next states that the Astronomer Royal, in a subsequent communication (in 1855), suggests that there is most probably a deficiency of matter immediately below the mountains which will cause a *negative* deflection, and so compensate for the mountain attraction. Three objections are urged against this hypothesis, as stated by Mr. Airy. It requires (1) that the solid crust should be only about ten miles thick; (2) that the crust should be lighter than the lava on which it rests; (3) that wherever there is a protuberance upwards in mountain masses and table-lands, there must be a corresponding projection of the crust downwards into the fluid, which it is difficult to conceive, as the same reason which is used to show it would prove also that, where there are hollows above as in deep

seas, there must be corresponding hollows in the solid crust below filled up by the lava, and this would point out a law of varying thickness in the crust which no process of cooling could well produce.

3. The author considers, however, that if there be a compensating cause it must lie in this direction; and he puts forth the hypothesis of deficiency of matter in a new form. He supposes that the mountain mass has risen up in consequence of a slight expansion of the solid crust below through many miles of thickness, producing a slight attenuation from a considerable depth. He calculates formulæ and reduces them to tables to find the effect of this attenuation, and shows that the mountain attraction, modified by this attenuation, if it extend down through 100 or 300, or 500 or 1000 miles (the attenuation being uniform along each vertical line), will produce the following deflections:—

At Kaliana. . . . 1″·538, or 6″·872, or 10″·912, or 16″·779.
„ Kalianpur. . 0″·064 „ 0″·369 „ 2″·425 „ 4″·661.
„ Damargida 0″·065 „ 0″·076 „ 0″·120 „ 1″·570.

4. These four sets of deflections are then applied to correct the amplitudes of the two portions of the arc, and by their comparison to find the ellipticity, which is shown to be, in the four cases,

$$\frac{1}{216'}\ \frac{1}{280'}\ \frac{1}{286'}\ \text{and}\ \frac{1}{385}.$$

So that although the hypothesis, if the depth of attenuation be about 100 miles, greatly reduces the deflection, it does not reduce the ellipticity to the mean value, which is attained only if the depth be somewhere between 500 and 1000 miles. There is little or no ground, therefore, for working with a mean ellipticity as is done in the Great Survey.

5. It is next pointed out that this theory will not explain the peculiarities of the Indian Arc under consideration; in which (according to Colonel Everest: see his volume for 1847, p. clxxvii), the upper portion has an excess in its amplitude, geodetically determined, of 5″·236, and the lower a defect of 3″·789. The presence of other disturbing causes near Kalianpur or Damargida, or both, is indicated by this; either in *visible* masses above, which ought to be accurately surveyed (as even small masses, if near enough, will produce the effect); or in *invisible* defects or excesses of matter

below, which it is impossible to discover, and therefore to estimate. The possibility, and even not small probability of such existing without our being able to detect and estimate them, throws an air of doubt and uncertainty over all geodetic operations, whenever it is necessary to know with precision the position of the vertical, freed from the influence of local disturbing causes. This *is* necessary for determining the curvature of the arc, that it may be used in both the problems of mapping the country with extreme accuracy, and of ascertaining the form of this part of the earth. A note is appended, illustrating the degree of influence which errors in the verticals and the ellipticities may have on the mapping.

6. The author next applies the results of his paper to ascertain the effect upon the plumb-line of an excess or defect of density, of only 1-100th part above or below the density required by the fluid-theory of equilibrium, and prevailing over wide-spread spaces in the interior of the earth. From the fact that specimens of rocks, even of the same description, found at the surface of the earth, vary considerably in density, he infers that it is not improbable that there may be as wide variations of density among the masses below, in addition to the variations arising from difference of distance from the centre of the earth and required by the fluid-theory of equilibrium. If this be the case, his calculation shows that his fears expressed in the last paragraph are not unfounded. The result of this part of the calculation is expressed in the following Table:—

TABLE OF DEFLECTIONS caused by a defect or excess of matter throughout a semicubic space of four millions of miles [*i. e.* 200 each way parallel to the surface, and 100 miles in the vertical], the mean density of the excess or defect being 1-100th part of the density of the earth at the depth of the centre of the cubic space.

Depth of the centre of the semi-cubic space.	Distance of the middle point of the space from the station, measured along the chord to the surface,				
	379 miles.	581 miles.	781 miles.	980 miles.	1173 miles.
	″	″	″	″	″
50 miles.	1·940	0·835	0·457	0·248	0·118
150 „	1·621	0·803	0·456	0·252	0·120
250 „	1·383	0·782	0·483	0·272	0·131
350 „	1·067	0·749	0·490	0·286	0·142
450 „	0·663	0·713	0·425	0·277	0·145

If the space be nearer to the station, or if the difference in density be more than 1-100th part, these deflections must be multiplied by a corresponding quantity.

7. The paper is concluded by a revision of some of the calculations in the former communication. The mass of the mountain region above the level of the plains is shown to be somewhat more than four-millionths of the mass of the earth.

III. "On the Thermal Effects of Compressing Fluids." By J. P. Joule, LL.D., F.R.S. &c. Received October 9, 1858.

(Abstract.)

The author in this paper gives an experimental demonstration of the correctness of Professor Thomson's formula, $\theta = \frac{Tep}{JK}$, where θ is the thermal effect, T the temperature from absolute zero, e the expansibility by heat, p the pressure, J the mechanical equivalent of the thermal unit, and K the capacity for heat. The fluids experimented on were water and oil, with the results tabulated below:—

	Temperature of the liquid.	Pressure applied in atmospheres.	Experimental result.	Theoretical result.
Water...	1°·2 Cent.	25·34	−0°·0083	−0°·0071
	5	25·34	0·0044	0·0027
	11·69	25·34	0·0205	0·0197
	18·38	25·34	0·0314	0·0340
	30	25·34	0·0544	0·0563
	31·37	15·64	0·0394	0·0353
	40·4	15·64	0·0450	0·0476
Oil	16	7·92	0·0792	0·0886
	17·29	15·64	0·1686	0·1758
	16·27	25·34	0·2663	0·2837

IV. "Note on Archdeacon Pratt's paper on the Effect of Local Attraction on the English Arc." By Captain Clarke, R.E. Communicated by Lieut.-Colonel James, R.E. Received June 30, 1858.

The following letter of Colonel James will explain the nature of this communication; the numerical statements, being not susceptible